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Fungi on higher plants of the upper limit of the alpine zone in Tian Shan

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Abstract — Fifty-two taxa of microfungi were noted at the upper limit of closed vegetation in Zailijskij Alatau Mts. (Tian Shan) in Kazakhstan, of which only 30% were saprobic species. Among the common and rare species were seven newly named taxa, six species new to science and one new combination. The complete annotated species checklist is available at http://www.mycotaxon.com/resources/weblists.html.

Key words — parasite, saprotroph, distribution, taxonomy

Introduction

The current study aims to assess microfungal diversity at the upper alpine plant limit in Tian Shan. The highly variable upper limit depends on many different factors, with different limits set for individual plants, plant communities, and closed vegetation (Grabherr et al. 1995). I investigated the limit of closed vegetation. Some information on fungi of the western part of Tian Shan has already been reported by Schwartzman (1962), Akhmedova (1966), Vasyagina (1977), Korbonskaya (1951, 1954), Salieva et al. (2002), Raitviir (2004), Chlebicki (2002, 2003, 2006, 2009), Chlebicki & Aime (2006), Chlebická & Chlebicki (2007), and Gaffyorov (2005). New species discovered since my research of the Zailijskij Alatau Mts. began in 2005 are *Cyathicula brunneospora* and *Pirottaea atrofusca* (Chlebická & Chlebicki 2007), *Microbotryum adenopetalae* (Lutz et al. 2008), and *Protoventuria juniperina*, *Trichometasphaeria barriae*, and *Veronaea thylacospermi* (Chlebicki 2009).

Materials and methods

Study area: The terminal glacier foreland of the Issyk valley in Zailijskij Alatau Mts. (Tian Shan) near Almaty in southern Kazakhstan was investigated. The study was conducted on the slope of a marginal moraine (inactive ground ca 300 m before the ice margin) of the uppermost small basin at the glacier front at 3436 m elev., N43°07'52.5" E77°30'25". A distinct limit of closed vegetation was present. The native plant habitats comprised initial soil partially covered by variously sized (1 cm–1 m diam) granite rocks. Material was collected from 16 permanent 2.5 × 2.5 m plots within a 10 × 10

m square (Fig. 1). Plants growing at the altitudinal limit belong to various growth forms such as cushion plants, mat forming forbs, rosette perennial plants, tussock graminoids, prostrate dwarf shrubs, and tiny bryophytes.

Methods: Dried material was examined under a Nikon SMZ 1500 zoom stereo microscope and at magnifications of 1000× and 2000× under a Nikon Labophot 2 or Olympus BX-51 light microscope, with Nomarski contrast (DIC) occasionally used. Microscopical observations and measurements of freehand longitudinal ascocarp sections were made in water and 3% KOH mountants. Lugol's solution (IKI: 1% iodine, 3% KI in water), Melzer's reagent (MLZ), and 5% KOH were used to determine the apical ring reactions and character of setae. Gelatinous sheaths of free ascospores were observed in India ink. Materials are deposited at the W. Szafer Institute of Botany of Polish Academy of Sciences in Kraków (Poland) and the National Museum in Prague (Czech Republic).

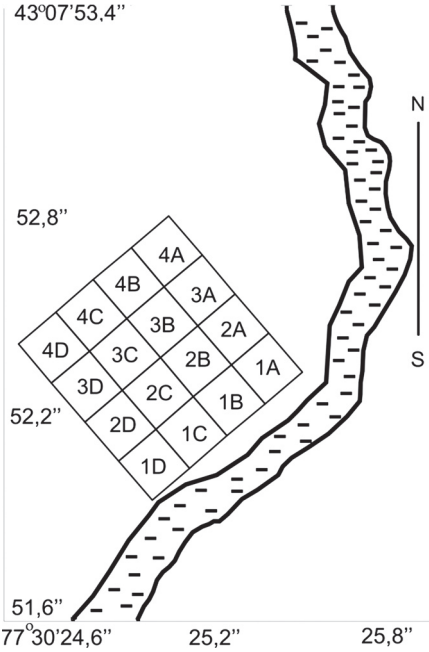

Fig. 1. The Tian Shan 10 m × 10 m permanent survey plot with 16 2.5 × 2.5 m quadrats (1A-4A, 1B-4B, 1C-4C, 1D-4D).

Results

Microfungi included 31 ascomycete species representing *Barrmaelia*, *Cainia*, *Cistella*, *Comoclathris*, *Cyathicula*, *Davidiella*, *Didymosphaerella*, *Glomerella*, *Hysteropezizella*, *Keissleriella*, *Lachnellula*, *Lophodermium*, *Mytilinidion*, *Nectriella*, *Phaeosphaeria*, *Phomatospora*, *Pirottaea*, *Pleospora*, *Protoventuria*, *Scutellinia*, *Trichometasphaeria* and *Wettsteinina* (*Pezizomycotina*); three rust species in *Melampsora*, *Microbotryum*, and *Puccinia* (*Pucciniomycotina*); a single *Ustilago* species (*Ustilagomycotina*); three *Agaricales* species in *Calyptella*, *Lagarobasidium* and *Typhula*; and 14 mitosporic species representing *Alternaria*, *Botrytis*, *Cladosporium*, *Fusarium*, *Heteropatella*, *Hymenella*, *Periconia*, *Phoma*, *Seimatosporium,* and *Veronaea*. Many host plants were abundant enough for fungus persistence. The presence of parasites on single plants (e.g., *Lachnellula arida* on *Juniperus sibirica*, *Melampsora epitea* and *Seimatosporium lichenicola* on *Salix alatavica*) indicates long-range dispersal. Other fungi had restricted distributions in spite of their host plants being common in the investigated

area (e.g., *Ustilago striiformis* on *Anthoxanthum alpinum*, *Microbotryum adenopetalae* on *Silene adenopetala*, *Puccinia saxifragae* on *Saxifraga cernua*, *Lagarobasidium detriticum* on *Carex griffithii*). The greatest number of fungal species was noted on tussock plants such as *Carex griffithii*, *Festuca coelestis,* and *Anthoxanthum alpinum*.

Discussion

It is very difficult to describe all fungi linked with single host plant, as competition and niche differentiation influence the composition of the fungal-plant association (Neubert et al. 2006). The upper limit of closed vegetation can be compared with Gotelli's (1991) metapopulation model, which shows the effect of propagule immigration during population size decrease. Chlebicki & Olejniczak (2007) noted that the number of fungal species on plants is directly proportional to the size of the host population. It is evident that host plants were accessible to fungus propagules originating from lower plant populations. The highest number of fungal species per host, however, were noted on the common tussock plants (Table 1).

Table 1. Number of fungi noted on investigated plants

Plant species	No. of fungi	Plant species	No. of fungi
1. *Anthoxanthum alpinum* Á. Löve & D. Löve	22	12. *Oxyria digyna* (L.) Hill	2
2. *Carex griffithii* Boott	28	13. *Pentaphylloides fruticosa* (L.) O. Schwarz	0
3. *Cerastium cerastoides* (L.) Britton	5	14. *Primula nivalis* Pall.	4
4. *Doronicum oblongifolium* DC.	0	15. *Pyrethrum karelinii* Krasch.	0
5. *Draba incurvata* A.N. Vassiljeva & Golosk.	3	16. *Salix alatavica* Kar. & Kir. ex Stschegl.	3
6. *Draba oreades* Schrenk	5	17. *Saussurea* sp.	5
7. *Dryadanthe tetrandra* (Bunge) Juz.	0	18. *Saxifraga cernua* L.	5
8. *Erigeron* sp.	0	19. *Saxifraga oppositifolia* L.	0
9. *Festuca coelestis* (St.-Yves) V.I. Krecz. & Bobrov	18	20. *Silene adenopetala* Raikova	9
10. *Juniperus sibirica* Burgsd.	3	21. *Thylacospermum caespitosum* (Cambess.) Schischk.	11
11. *Leontopodium leontopodinum* (DC.) Hand.-Mazz.	1	22. *Waldheimia tridactylites* Kar. & Kir.	7

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